We Care for a Better Future.

Role of CHP in Future Energy Mix

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2G. Cogeneration.

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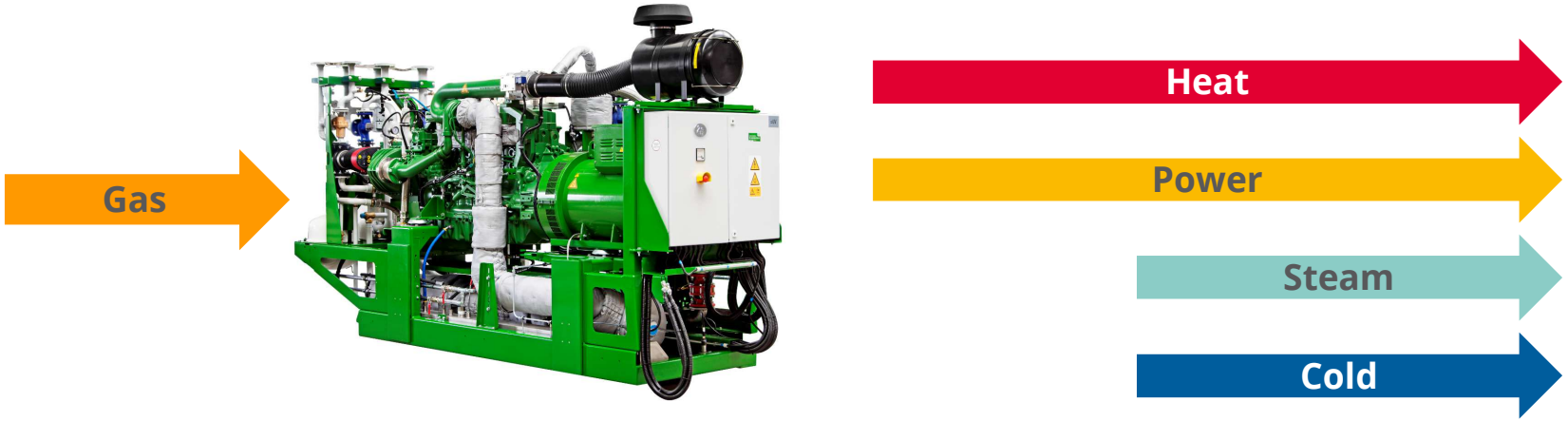
2G Energy AG - Key Data.

- Founded 1995 - Headquarters in Heek in North West of Germany
- Solution provider: development, project engineering, production, service, financing
- Plants for biogas, natural gas and hydrogen applications
  20 – 4,000 kW electrical power
- Strong focus on R&D
- 9 national and international subsidiaries
- Since 2007 listed at the German stock market
- 700 employees worldwide
- 6,500 CHP plants in more than 50 countries worldwide
- 236 Mio EUR turnover

Sustainable and Efficient Solution.



Technical advantages CHP:

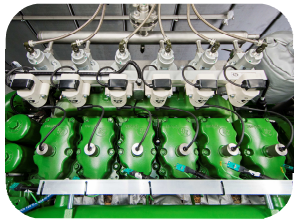
The heat of the combustion process can be used (more than 90% total efficiency)

- Decentral and highly flexible
- Reliable System (Security of Supply)

Main Characteristics of CHP in the future.

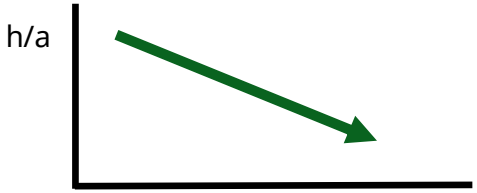
Natural Gas today....

...Hydrogen tomorrow



Hydrogen-readiness/ Renewable-gas-readiness

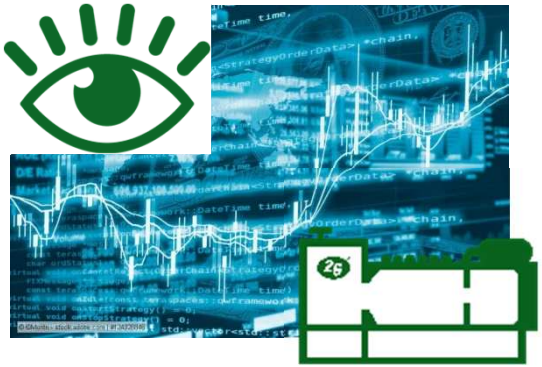
Bigger CHP...



... less operating hours

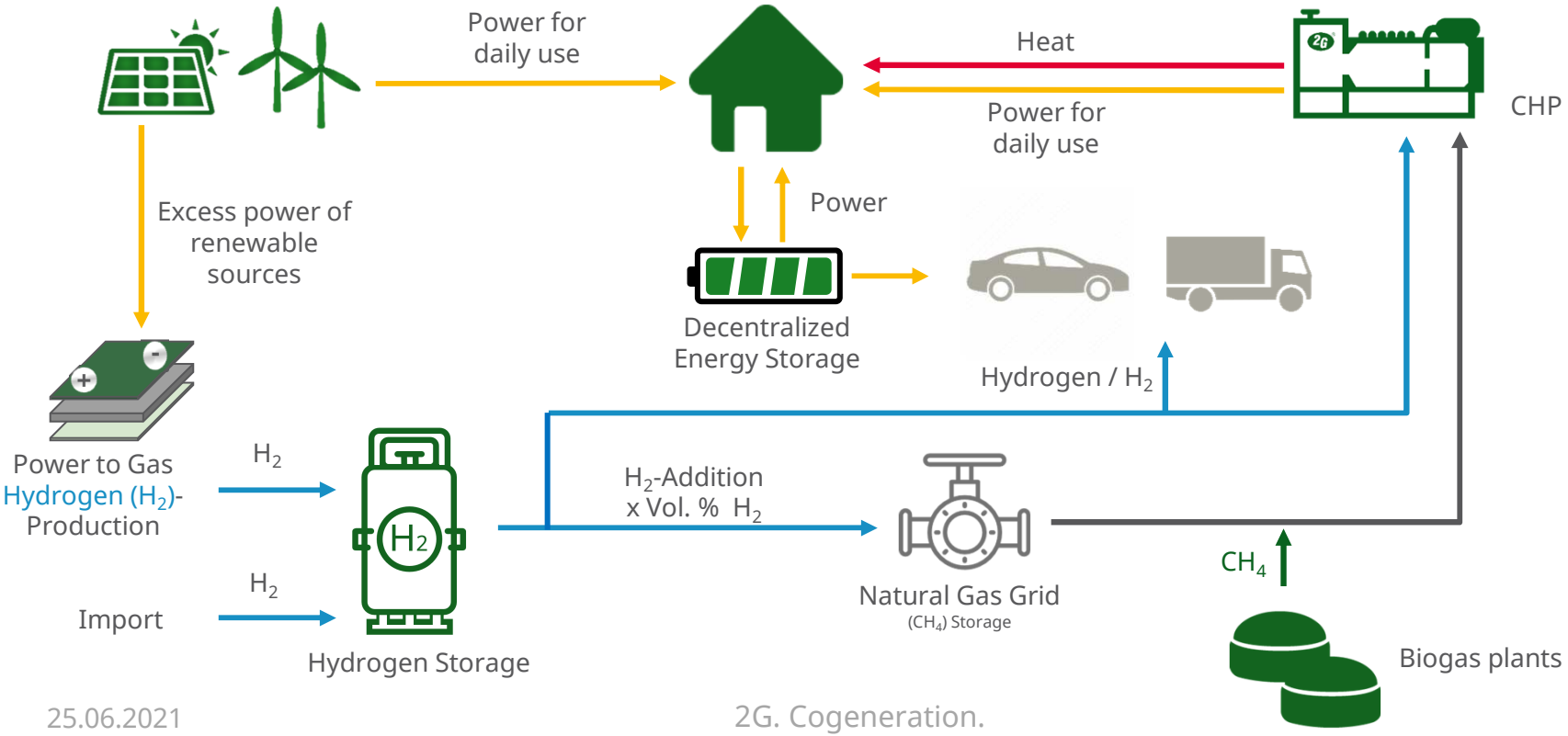
Increase of installed CHP capacity per project

- Immediate reaction on market signals
- Avoidance of down-times
- Smart maintenance
- Self-learning machines

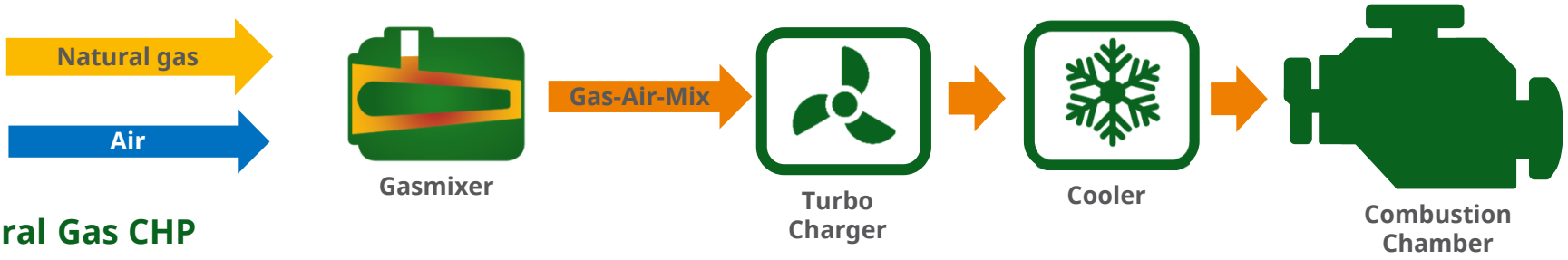


Smart and digital integration into the energy mix

Sectoral Coupling.

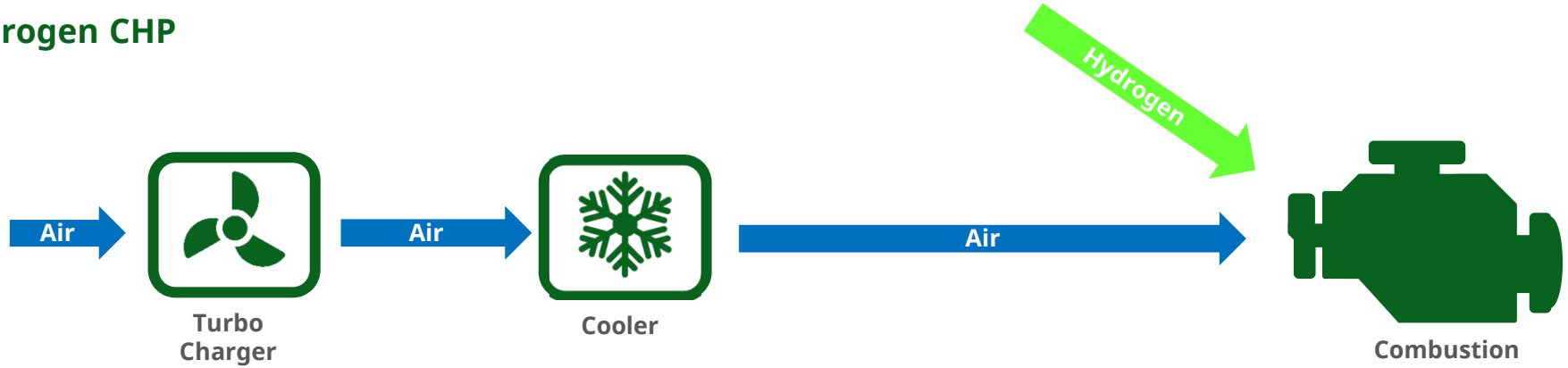


Comparison: Natural Gas CHP vs. Hydrogen CHP



Natural Gas CHP

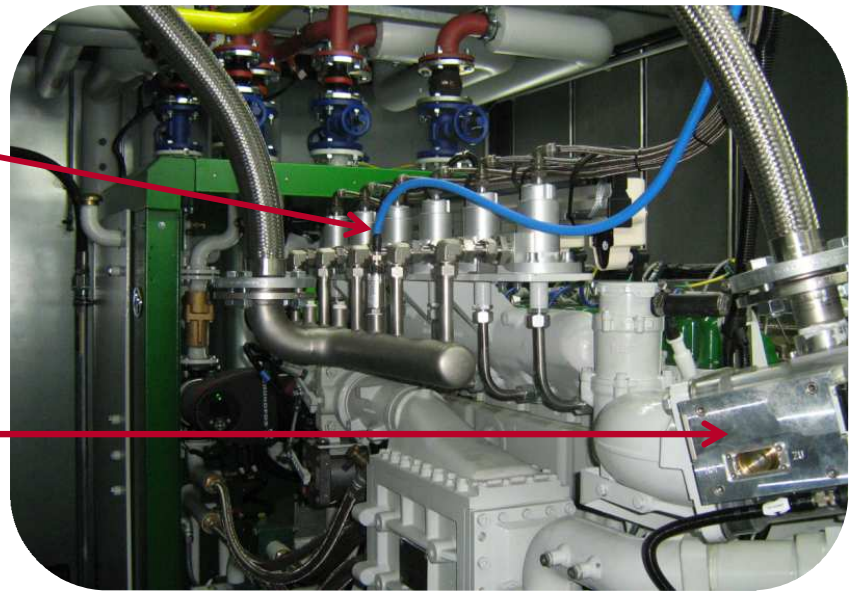
Hydrogen CHP



Combination of Hydrogen / Natural Gas Operation

Gas injection for hydrogen operation

Regular gas mixer



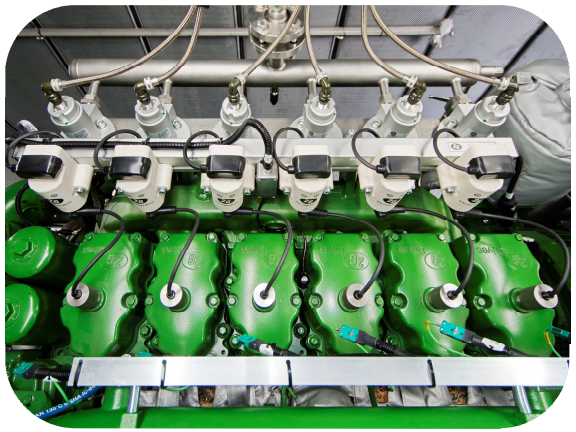
Switch between hydrogen / natural gas (biogas) operation enables covering peak demand

Hydrogen CHP by 2G

- Gas train for Hydrogen
- Gas injection at each cylinder (multipoint injection)
- Special 2G spark plug & pistons
- Partial load capability from 50 – 100 % nom. load
- Island operation with large loads is possible
- Gas Blending is possible (e.g. NG / H2)
- “Waste” Hydrogen containing impurities can be utilized
- 2G engines can be retrofitted to H2 in the future

Today Natural Gas - Tomorrow Hydrogen.

Natural Gas



Hydrogen

References.

TOTAL Hydrogen Service Station / Berlin (Germany)
agenitor 306 H_2 with 2G hydrogen technology

Stadtwerke Haßfurt / Haßfurt (Germany)
agenitor 406 H_2 with 2G hydrogen technology

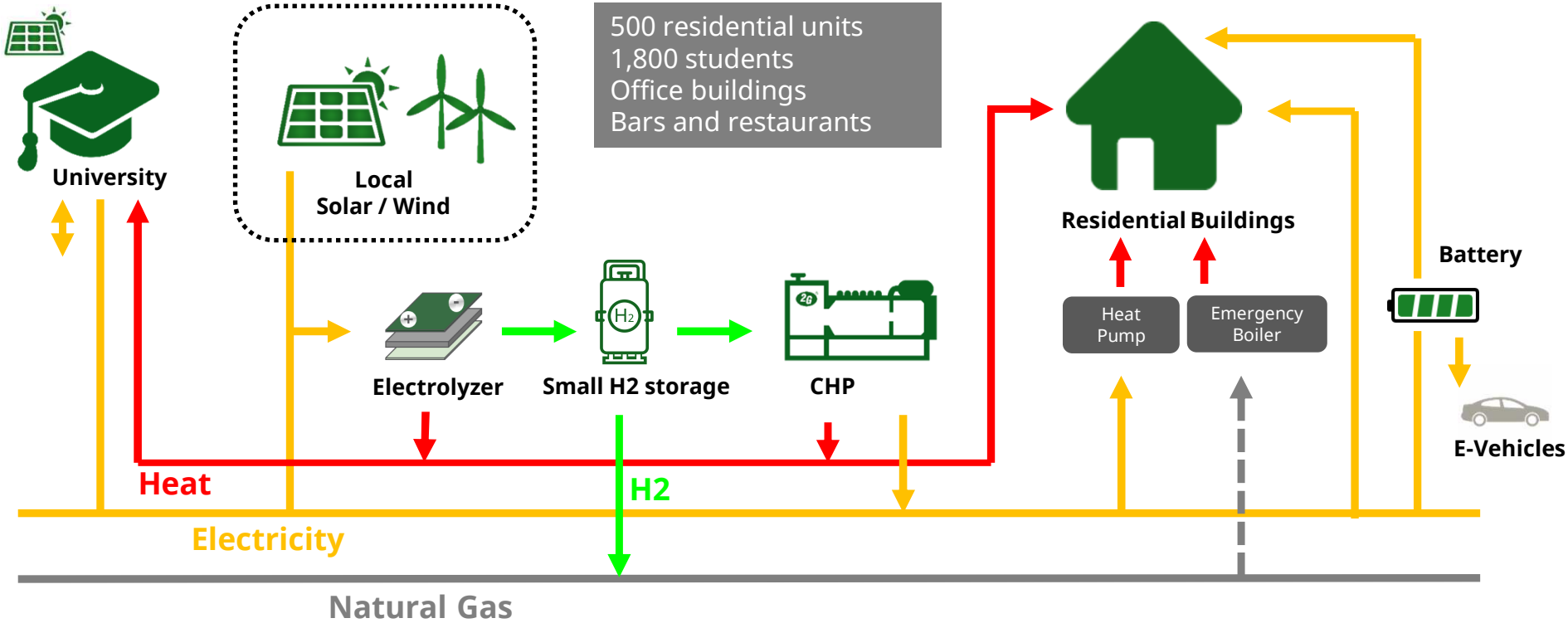
Siemens (Dubai)
agenitor 412 H_2 with 2G hydrogen technology

APEX / Rostock (Germany)
agenitor 404c H_2 with 2G hydrogen technology

Climate Neutral Quarter Esslingen (Germany)
agenitor 406 H_2 with 2G hydrogen technology

Oakney Airport (UK)
agenitor 404c with H_2 with 2G hydrogen technology

Case Study: City of Esslingen (Germany)



2G Hydrogen Portfolio.

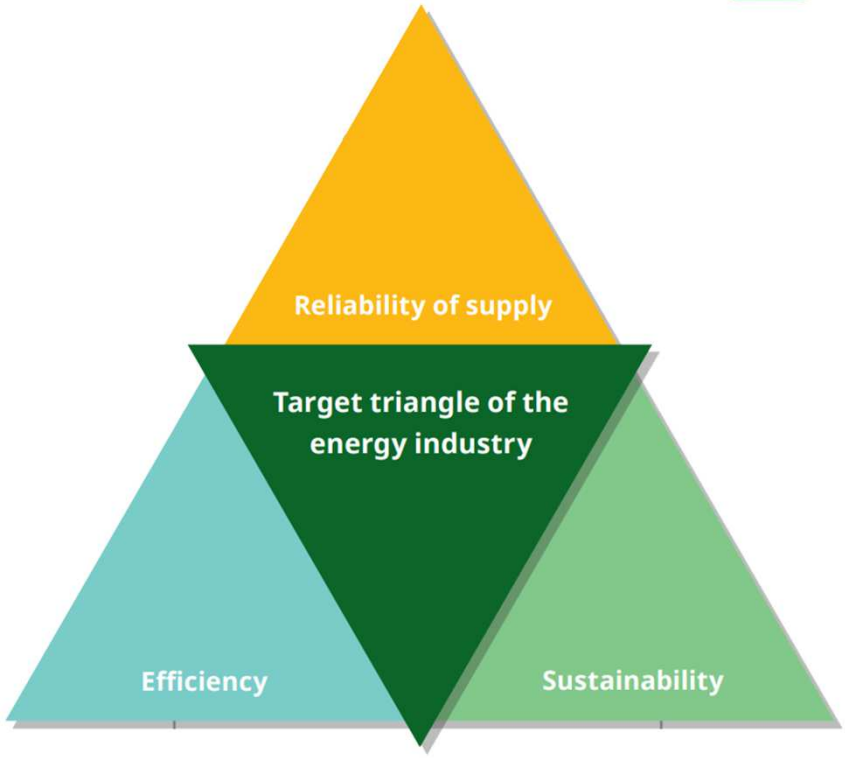
Type	Output		Efficiency Rate		
	Electrical	Thermal	Electrical	Thermal	Total
agenitor 404c H_2	115 kW	129 kW	37.7 %	42.3 %	80.0 %
agenitor 406 H_2	170 kW	183 kW	39.0 %	41.9 %	80.9 %
agenitor 408 H_2	240 kW	250 kW	40.2 %	41.9 %	82.1 %
agenitor 412 H_2	360 kW	371 kW	40.5 %	41.7 %	82.2 %
agenitor 420 H_2	750 kW	747 kW	41.2 %	41.0 %	82.2 %

Summary – CHP systems are….

1. …part of the renewable energy storage solution in order to re-electrify the wind and solar energy stored in the gas system in a highly efficient manner

2. …the natural partner technology for PV systems due to the complementary mode of operation

3. …system-relevant and can cover the residual load highly efficient as required



Thank you very much for your attention!

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